INSTRUCTION AND MAINTENANCE MANUAL

LOW NOISE PREAMPLIFIER

ITHACO MODEL 1201

NOVEMBER 1980

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MANUAL CHANGES

MODEL 1201 LOW NOISE PREAMPLIFIER

Date January 15, 1980 Supplement A

Make all changes in this manual according to the Errata below. Also check the following table for your instrument serial number and make the listed changes in your manual.

MODEL	SERIAL NO	MAKE MANUAL CHANGES	MODEL	SERIAL NO	MAKE MANUAL CHANGES
1201	ALL				

CAUTION: NOT FOR USE ON HUMAN SUBJECTS

The ITHACO Model 1201 Low Noise Preamplifier was designed to meet the low level signal processing requirements in many applications, including biological studies.

However, the Model 1201 is not recommended for use on human subjects, and ITHACO expressly discourages such use.

Although safety consideration was one of the major design philosophies incorporated in the Model 1201, there is always the small chance of internal component failures.

If such failures were to occur under certain conditions with the Model 1201 connected to the patient, dangerous current levels could flow through the subject. This is especially true if the skin resistance of the subject were compromised in which case the subject would become part of a low impedance path.

The Model 1201 is, however, an excellent low noise preamplifier for use in biological studies on non-human subjects and for such studies its use can be considered consistent with an acceptable risk.

SECTION I

INTRODUCTION

1.1 DESCRIPTION

The ITHACO Model 1201 is a low noise voltage preamplifier, capable of amplifying low level voltages from DC to 400 kHz. Voltage gain from 10 to 25,000 is provided by using the gain switch and its associated vernier control. Discrete steps in gain are provided in a 1-2-5 sequence from X10 to X10,000 and may be increased by a factor of 2.5 by using the variable gain control.

Adjustable high pass and low pass rolloffs allow the bandwidth to be easily controlled.

Input is provided via two front panel BNC's and may be either AC or DC coupled. Each input, which has its own coupling switch allows the user to operate in either the single-ended or differential input mode.

An internal battery pack is provided consisting of two rechargeable nickel cadmium 1.2A-hr. battery packs. When fully charged, they will operate the 1201 in excess of 25 hours under normal operating conditions. A battery test switch and indicator is provided on the front panel. This indicates to the operator whether the battery has sufficient voltage to operate the 1201.

Additional features include front panel adjustment of CMR and precise DC zeroing, overload recovery switch and overload indicator (monitors all critical points in the 1201). Gated operation is also provided as well as four different outputs from the 1201 (2-600 ohm, 50 ohm and X1).

With the Remote Programming Option -06, the 1201 may be interfaced to computers and programmable calculator systems. Full gain control with gain status and overload/recovery is possible. Front panel high pass and low pass filter switch settings can be read out. The Remote Programming Option -06 also allows computer-controlled gated operation.

1.2 SPECIFICATIONS

See Specifications on next page.

Overload indicator (all critical circuit points)

Vernier gain for continuous control to 2.5X gain switch setting

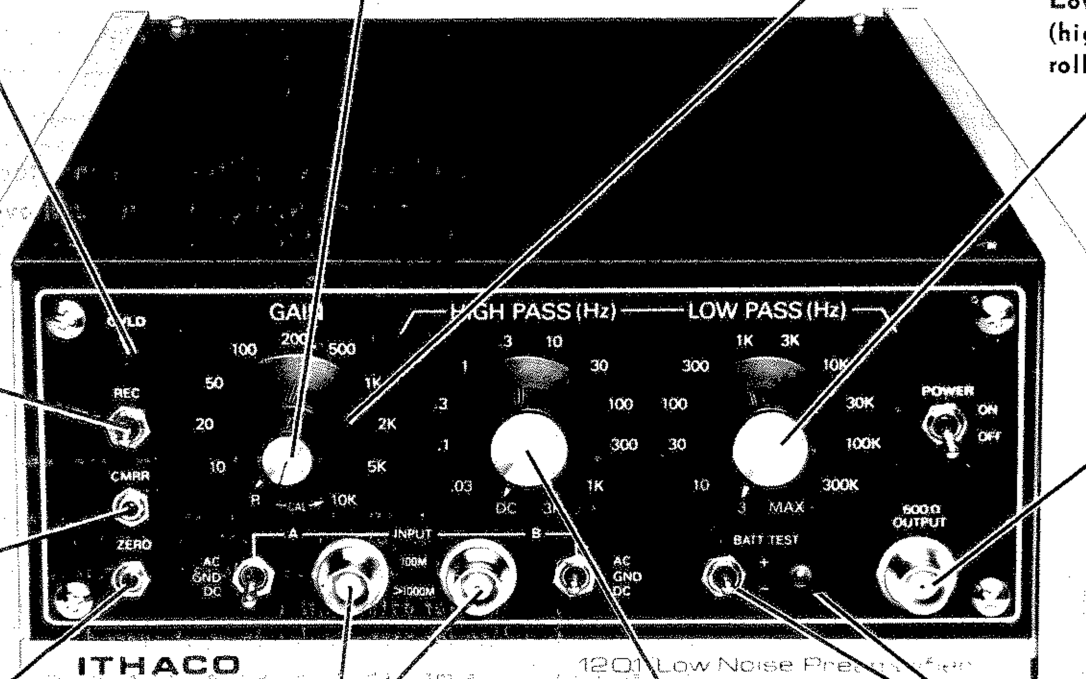
Gain switch for 1–2–5–10 gain sequence

Low pass filter (high frequency rolloff) control

Manual switch for overload recovery

Adjustment for common mode rejection ratio

600–ohm output (parallels rear panel 600-ohm output)



Adjustment for precise DC zeroing

Inputs with selectable true differential or single–ended modes, DC and/or AC coupling

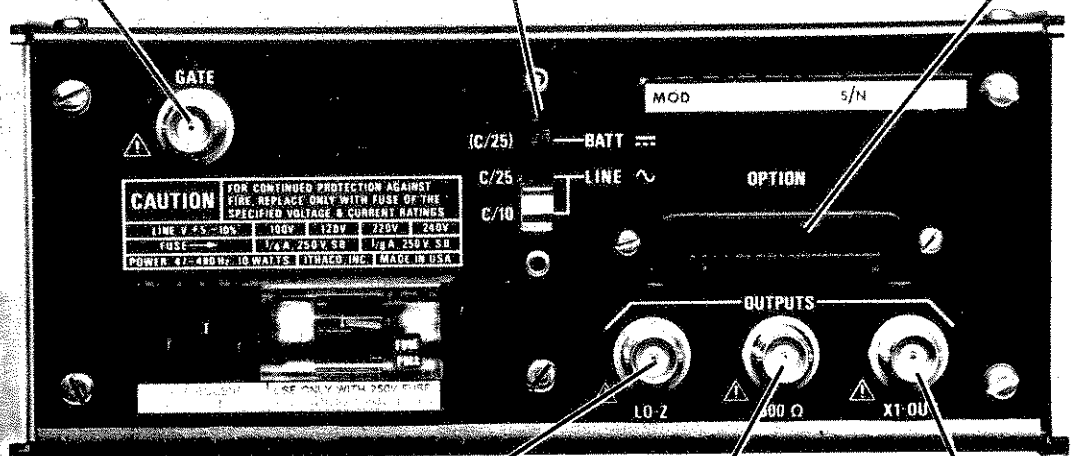
High pass filter (low frequency rolloff control)

Battery test switch indicator (green indicates adequate charge)

Input for external gating signal (or contact closure)

Battery charge rate selector switch

Remote programming option inputs/outputs



Low impedance (50 ohm) output, up to 25mA at any gain and over total frequency range.

600–ohm output (parallels front panel 600–ohm output)

Unity–gain (X1) output, up to 7mA over total frequency range.

MODEL 1201 REMOTE PROGRAMMING OPTION 06

ITHACO

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The Remote Programming Option permits the Model 1201 Low Noise Preamplifier to be interfaced directly to computers and programmable calculator systems. Full gain control, with gain status and overload indication/recovery, is featured. Front panel high pass and low pass filter switch settings can be read out. Option 06, when installed in the Model 1201, also allows computer-controlled gated operation.

Programming format for Option 06 is BCD-coded. As outlined, there are twelve input lines, twelve output lines, two output select lines and two external pull-up lines.

FUNCTION		DESCRIPTION
INPUTS (12 Lines)	1. GAIN CONTROL	3 lines for gain value mantissa command. 3 lines for gain value exponent command.
	2. GATING	1 line for gate control. 1 line for rear panel gate input override.
	3. OVERLOAD RECOVERY	1 line for instantaneous overload recovery, parallel operation with front panel overload recovery switch.
	4. LATCH	1 line to latch gain command. 1 line to latch gating and overload recovery.
	5. DEVICE SELECT	1 line inactivates all option outputs (excluding overload) and latches all option inputs. NOTE: Device select line serves as general purpose enable function and can be used to multiplex several Model 1201 preamplifiers.
OUTPUTS (12 Lines)	1. GAIN INDICATION	3 lines for gain value mantissa output. 3 lines for gain value exponent output. 1 line for exponent sign (polarity). 1 line for indication of uncalibrated gain when front panel gain vernier is not in CAL position.
	2. REMOTE	1 line to indicate remote operation of Model 1201 (front panel gain switch in "R" position).
	3. ERROR	1 line for indication of incorrect gain command.
	4. OVERLOAD	1 line for indication of overload condition, parallel with front panel overload indicator (for wired-OR operation). 1 line for indication of overload condition, dependent upon device select line (for multiplexed operation).
OUTPUT SELECT (2 Lines)	1. GAIN INDICATION	Gain readout when both lines are activated (high condition).
	2. HIGH PASS FILTER	High pass filter readout when 1 line is activated.
	3. LOW PASS FILTER	Low pass filter readout when 1 line is activated.
	4. IDENTITY	Model identification when both lines are inactivated (low condition).
EXTERNAL PULL-UP (2 Lines)	1. OPTION INPUTS	1 line for external pull-up when internal jumper is transferred from +5 volt supply to external; permits external pull-up to +15V maximum.
	2. OPTION OUTPUTS	1 line for external pull-up when internal jumper is transferred from +5 volt supply to external; permits external pull-up to +15V maximum.

SPECIFICATION		LIMITS
GENERAL	1. GAIN CHANGE RATE	Gain change command rate (any span) to 10 commands per second.
	2. OUTPUT SELECT SETTLING TIME	50 microseconds maximum.
	3. INPUT LEVELS	Low state: 0 – 0.7V. High state: +5V nominal (internal pull–up). High state: to +15V maximum (when external pull–up line is activated).
	4. INPUT IMPEDANCE	68k nominal.
	5. INPUT CURRENT	CMOS Input (1/20 TTL load).
	6. OUTPUT LEVELS	Low state: 0 – 0.7V. High state: +5V nominal (internal pull–up). High state: to +15V maximum (when external pull–up line is activated).
	7. OUTPUT SINK CURRENT	3.2mA minimum.
	8. INDICATION	Positive true, all inputs and outputs, except gate control, gate override, overload recovery and overload output.
	9. CONNECTOR	Amphenol Micro Ribbon* type 57–30360, 36–pin.

* Registered trademark of Amphenol

1.3 1201-06 INITIAL CHECKOUT - REMOTE PROGRAMMING OPTION

As shipped, the 1201-06 Remote Programming Option will have no effect on the 1201 operation. However, if connections are made to the rear panel connector, the option may take control, and some confusing situations may result. Therefore, the following check out procedure is recommended to help gain familiarity with this option, and to check its functionality.

NOTES: When making connections to the OPTION Connector, use the mating connector supplied or other suitable means to avoid damaging the 1201.

- CAPITAL LETTERS indicate items on the 1201.
- PIN numbers refer to the Rear Panel OPTION connector.

PROCEDURE

1. Remove any connectors to the OPTION and GATE connectors.

2. Check the function of the 1201 per section 3.3.5.

3. Connect test equipment to the 1201 as shown in Figure 1.3.1.

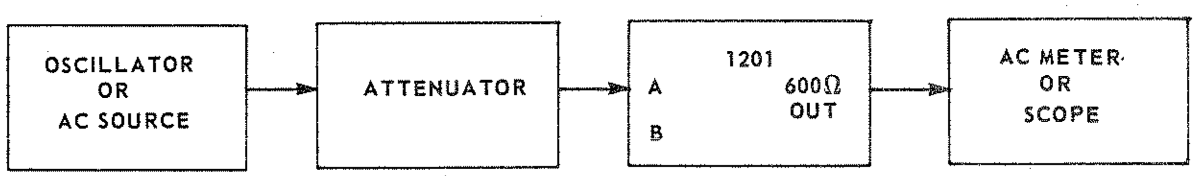


FIGURE 1.3.1 Initial Test Setup

4. Set 1201 controls

VAR GAIN	CAL
GAIN	10
INPUT A	AC
INPUT B	GND
HIGH PASS	DC
LOW PASS	MAX
POWER	ON
BATTERY	C/25-LINE

Observe a gain of 10 by using the external oscillator/attenuator and meter or scope. The OVLD indicator should be unlit.

5. INTERNAL PULLUPS

Check the DC Voltage at PIN 36 (GCE2) on the option connector for about +5V (input selector set to INT). Likewise, check PIN 18 ($\overline{\text{OVLD}}$) for about +5V (output selector set to INT).

6. POWER-ON DEFAULT (GAIN)

Switch GAIN to "R" (remote). Gain should still be 10 (power up default state). If not, try turning power off momentarily.

7. OVERLOAD OUTPUTS

Change GAIN to 20 causing 1201 to overload. Note that the voltage at PIN 18 (OVLD) goes low (≈0 VDC) and PIN 17 (OVLD+DSEL) goes high.

8. OVERLOAD RECOVERY

Temporarily connect PIN 30 (RECY) to ground (PIN 9), and observe that the overload condition goes away.

9. GATE CONTROLS

a. Reduce GAIN to 10, eliminating Overload.
b. Short the GATE INPUT BNC, and observe that the 1201 gain has gone to zero.
c. Connect PIN 31 (GOR) to ground. Observe that the option "Gate OverRide" has defeated the rear panel GATE INPUT function, and that:
d. When PIN 32 (GATE) is now grounded, the 1201 gain goes to zero. The "Gate Override" has given control to the GATE input.
e. Remove the connection to PIN 31 (GOR), and observe that PIN 32 (GATE) no longer has control.

10. RECOVERY AND GATE CONTROL LATCH

a. Ground PIN 31 (GOR) and PIN 32 (GATE). 1201 Gain has now gone to zero.
b. Ground PIN 36 (GCE2)-Gain Change Enable, and observe that no combination of inputs at PINS 31, 32 or the GATE INPUT BNC now have any effect.
c. Remove all PIN connections.
d. Change GAIN to 20, causing overload.
e. Ground PIN 30 (RECY). The Overload condition has gone away.
f. Ground PIN 36 (GCE2) and note that releasing PIN 30 (RECY) now has no effect.

11. POWER ON DEFAULT (GATE & RECOVERY)

a. Ground PIN 36 (GCE2), PIN 30 (RECY), PIN 31 (GOR) and PIN 32 (GATE). Remove any connection to GATE INPUT BNC.
b. Temporarily turn POWER off.
c. Observe that the unit is overloaded, and that grounding the GATE INPUT or pushing the OVERLOAD RECOVERY SWITCH will eliminate the overload.
d. Remove all PIN connections and GATE INPUT connection.

12. GAIN READOUT

a. Connect a display device to PINS 2, 3, 4, 5, 6, 11, 12, 13, 14, 16. PINS 7 and 15 may also be monitored. The circuit in Figure 1.3.2 is recommended if nothing else is available.

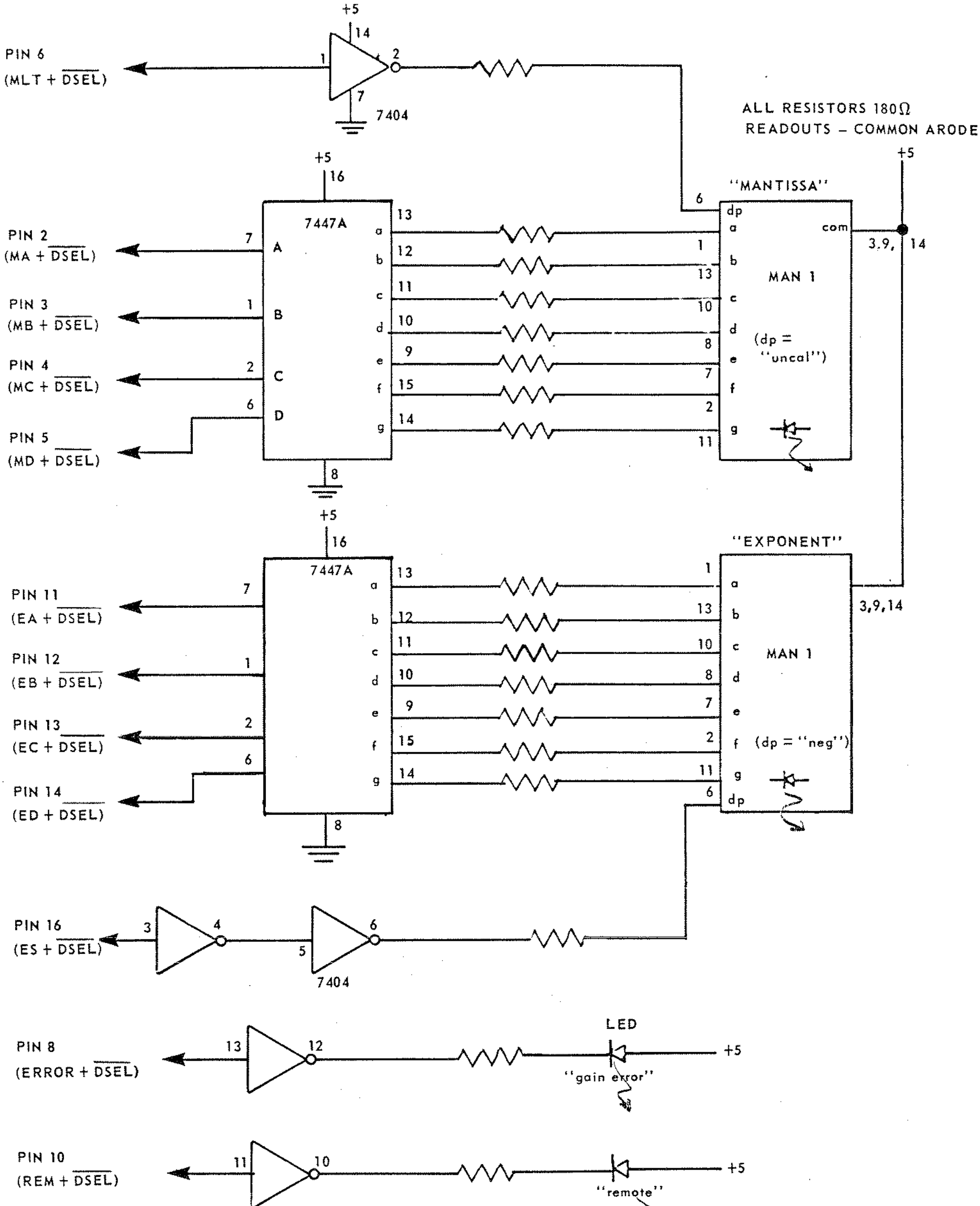


FIGURE 1.3.2 OUTPUT DISPLAY CIRCUIT

b. Set GAIN to 20, and observe the display. The "Mantissa" readout will be "2" and the "Exponent" readout will be "1", indicating a gain of 2×10^1 or 20. The "Uncal" and "Neg" readouts will be off. Ignore the "gain error" light.

c. Change the GAIN throughout its range and verify that the display represent the GAIN setting.

d. Rotate the VARIABLE GAIN CONTROL and note that the "uncal" light turns on.

13. SWITCH READOUTS

a. Ground PIN 27 (SEL 1). HIGH PASS is now SELected. Observe that the display reads "00" ("DC").

b. Change HIGH PASS to .03. The display should now read 3.2 indicating 3×10^{-2}.

c. Continue through other HIGH PASS settings.

d. Note that the position of the VARIABLE GAIN CONTROL has no effect on the "uncal" display.

e. Remove wire to PIN 27 (SEL 1) and Ground PIN 28 (SEL 2). The LOW PASS is now SELected and the display will be "00" indicating "MAX".

f. Rotate the LOW PASS SWITCH through its other settings and observe the correct display.

14. IDENTITY READOUT

Ground PIN 27 (SEL 1) and PIN 28 (SEL 2). The display will now read "01" indicating model 1201.

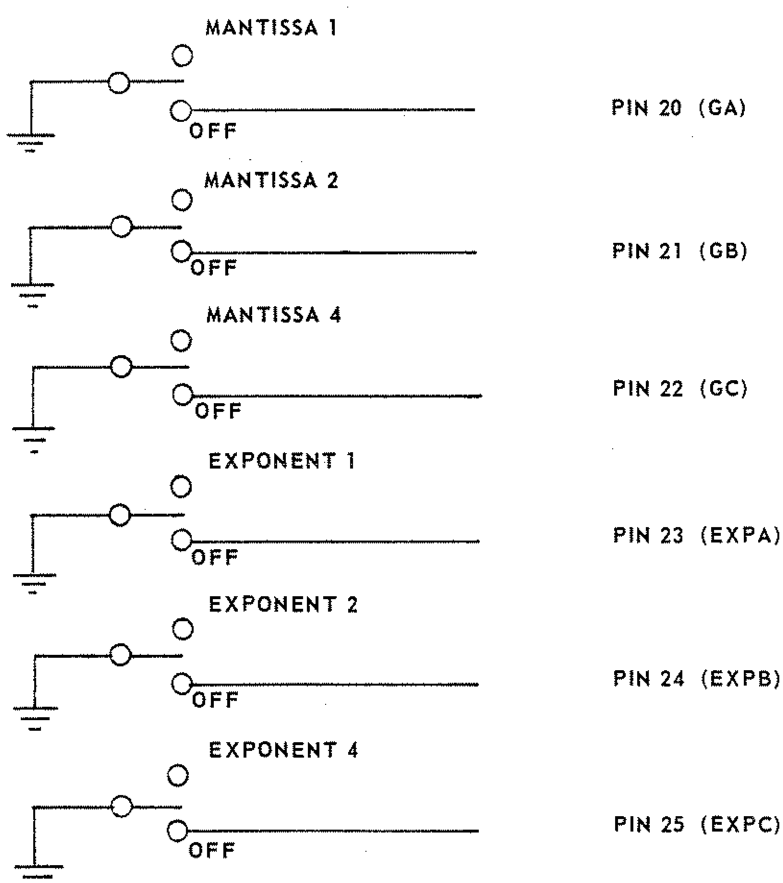


FIGURE 1.3.3 GAIN INPUT SWITCHES

15. GAIN CONTROL

a. Return the 1201 to the original settings. (PROCEDURE Step

b. Connect switches to the GAIN CONTROL INPUTS (PINS 20, 21, 22, 23, 24, 25) per Figure 1.3.3 or use an equivalent circuit.

c. Observe that the display reads "11" and ignore the "gain error" light. Note that the "remote" light is off.

d. Change the GAIN to "R" and set the remote switches to:

MANTISSA			EXPONENT		
4	2	1	4	2	1
OFF	OFF	ON	OFF	OFF	ON

Note that the display reads "11", the "error" light is off, and the "remote" light is on. Use the attenuator, scope, etc. to verify that the 1201 gain is 10.

e. Sequence through remote switches and note the following results (only on states are shown).

MANTISSA			EXPONENT			DISPLAY	ERROR	REMOTE	1201 GAIN
4	2	1	4	2	1	---	---	---	---
	ON				ON	21	(OFF)	ON	20
ON		ON			ON	51		ON	50
		ON		ON		12		ON	100
	ON			ON		22		ON	200
ON		ON		ON		52		ON	500
		ON		ON	ON	13		ON	1000
	ON			ON	ON	23		ON	2000
ON		ON		ON	ON	53		ON	5000
		ON	ON			14		ON	10000

16. GAIN ERROR DETECTOR

Enter the following combinations on the switches and note that the "error" light is on for each. Ignore any strange effects this may have on gain or display readings. This is only a partial listing.

MANTISSA			EXPONENT			ATTEMPTED GAIN
4	2	1	4	2	1	
(OFF)	(OFF)	(OFF)	(OFF)	(OFF)	(OFF)	0
		ON				1
	ON					2
ON						4
	ON	ON			ON	30
ON					ON	40
ON	ON	ON			ON	70
ON				ON		400
ON	ON			ON		600
ON	ON	ON		ON		700
	ON	ON		ON	ON	3,000
ON	ON	ON		ON	ON	7,000
	ON		ON			20,000
	ON	ON	ON		ON	300,000
ON		ON	ON	ON		5,000,000
ON	ON	ON	ON	ON	ON	70,000,000

17. GAIN LATCH

a. Set the remote switches to:

MANTISSA			EXPONENT		
4	2	1	4	2	1
	ON				ON

observe that the display reads "21".

b. Connect PIN 35 (GCE1) to ground, and observe that no setting of the remote switches now has any effect on the gain. The only effect on the display will be that the "gain error" light will still be functional.

c. Go back to condition 17a.

d. Change Mantissa 4 switch to "ON". Note that the display still reads "21" and that the gain has not changed.

e. Rotate the GAIN SWITCH from "R" to other gain settings. The display and preamp gain will follow the GAIN SWITCH. The "gain error" light will stay with the setting on the remote switches.

f. Return the GAIN SWITCH to "R". Note that the display has returned to "21".

g. Disconnect PIN 35 (GCE1) from ground.

18. DEVICE SELECT LINE

a. Set the GAIN SWITCH to "100". Adjust attenuator for no overload on 1201.

b. Set remote switches to condition at step 17a. (GAIN=20)

c. Connect PIN 34 (DSEL) to ground.

d. Note following conditions:

display	BLANK (except dp)
"gain error"	ON
"remote"	ON
"uncal" (dp)	ON
"neg" (dp)	OFF

voltage at PIN 17 ($\overline{\text{OVLD+DSEL}}$) is ≈5VDC
voltage at PIN 18 ($\overline{\text{OVLD}}$) is ≈5VDC

e. Sequence remote switches through:

MANTISSA			EXPONENT		
4	2	1	4	2	1
	ON				ON
	ON			ON	ON
ON	ON			ON	ON

f. Change GAIN SWITCH to "R".

g. Recheck condition in 18d. All should be the same except PIN 18 which will now be ≈0 VDC.

h. Disconnect ground from PIN 34 (DSEL) and observe that the display reads "21" (not "23").

i. A similar exercise can be done to show that the Gate Control and Overload recovery lines are inactive when DSEL is low.

SECTION 2

INSTALLATION

2.1 INSPECTION

2.1.1 GENERAL

Before shipment, the Model 1201 was found to be free of electrical and mechanical defects. As soon as the instrument is unpacked, inspect for any damage that may have occurred in transit. Save all packing material until the inspection is complete. If damaged in any way, a claim should be filed with the carrier and a copy forwarded to ITHACO. ITHACO will then advise you as to the disposition of the equipment and will arrange for repair or replacement of the equipment without waiting for a settlement of a claim against the carrier.

2.1.2 VISUAL INSPECTION

A visual check should be made to confirm that there are no broken knobs or connectors, that the case and panel surfaces are free of dents and scratches and that the frame, transformer, battery pack and bail assembly are undamaged.

2.1.3 ELECTRICAL INSPECTION

The instrument should be checked againsts its electrical specifications (see Section I).

2.2 INSTALLATION

The 1201 Low Noise Preamplifier needs only to be connected to a power source for normal bench top use. See Section 2.3, "Power and Grounding".

For those installations where rack mounting is desired, two rack mounting kits are available: Model RM-1 for two 1201's side by side; Model RM-2 for a single 1201 in a 19" rack.

2.3 POWER AND GROUNDING

Unless otherwise specified, all units are shipped with a six foot, three conductor power cord equipped with a grounded plug. Normally, the 1201 should be connected to a grounded power source.

Before connecting the 1201 to the line, check that the line voltage switch (inside rear panel connector) is in the proper position.

50-400 Hz Setting	Voltage Range	Recommended Slo-Blow Fuse
100	90-110 VAC	0.25A
120	105-130 VAC	0.25A
220	195-240 VAC	0.125A
240	210-260 VAC	0.125A

To change the power setting, first turn off the unit. Remove the power cord and slide the plastic window to one side. Remove the fuse by pulling out on the "fuse pull" lever. Remove the small printed circuit board by hooking a stiff wire in the hole at the rear of the board and pulling straight out. Select the proper voltage setting from the above table and orient the board so the desired setting will be visible through the window when the board is reinserted. Reinsert the board in the desired orientation, install the proper fuse and push the "fuse pull" lever back. Slide the window back and reconnect the power cord.

For battery operation, see Section 4 "Battery Operation and Maintenance".

SECTION 3

OPERATING INSTRUCTIONS

3.1 GENERAL

The ITHACO Model 1201 is a powerful laboratory instrument for use wherever low level, low noise signal processing is required. The following paragraphs outline general operating instructions for the 1201.

For a "quick glance" description of all the controls, inputs and output connections, refer the Figure 3.1. A detailed description of each function and control is treated in Section 3.3.

3.2 INITIAL CHECKS

As a "get acquainted" exercise, set the amplifier up in the following test setup (Figure 3.2). Set the controls to the following settings:

Rear Panel Power Setting	consult Section 2.3 for proper power setting
Batt, C/10, C/25 (rear panel)	C/25
Gain	X10, CAL
Low Pass	MAX
High Pass	DC
Input A (AC-GND-DC)	DC
Input B (AC-GND-DC)	GND
On/Off	OFF

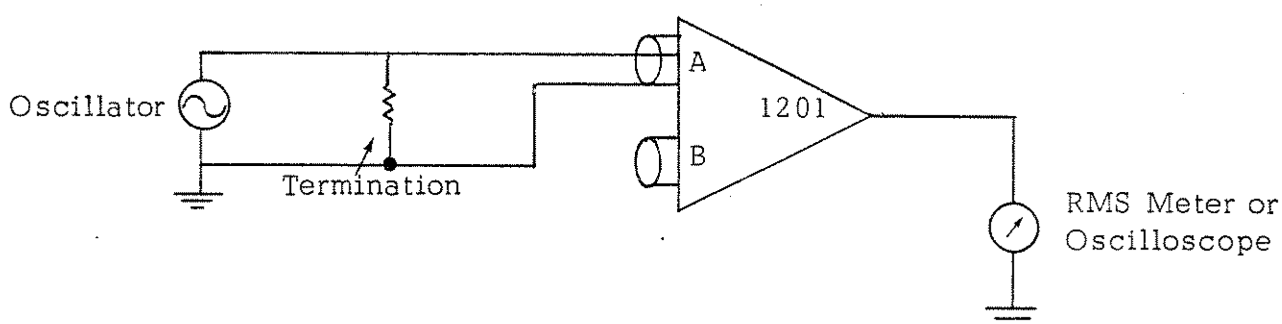
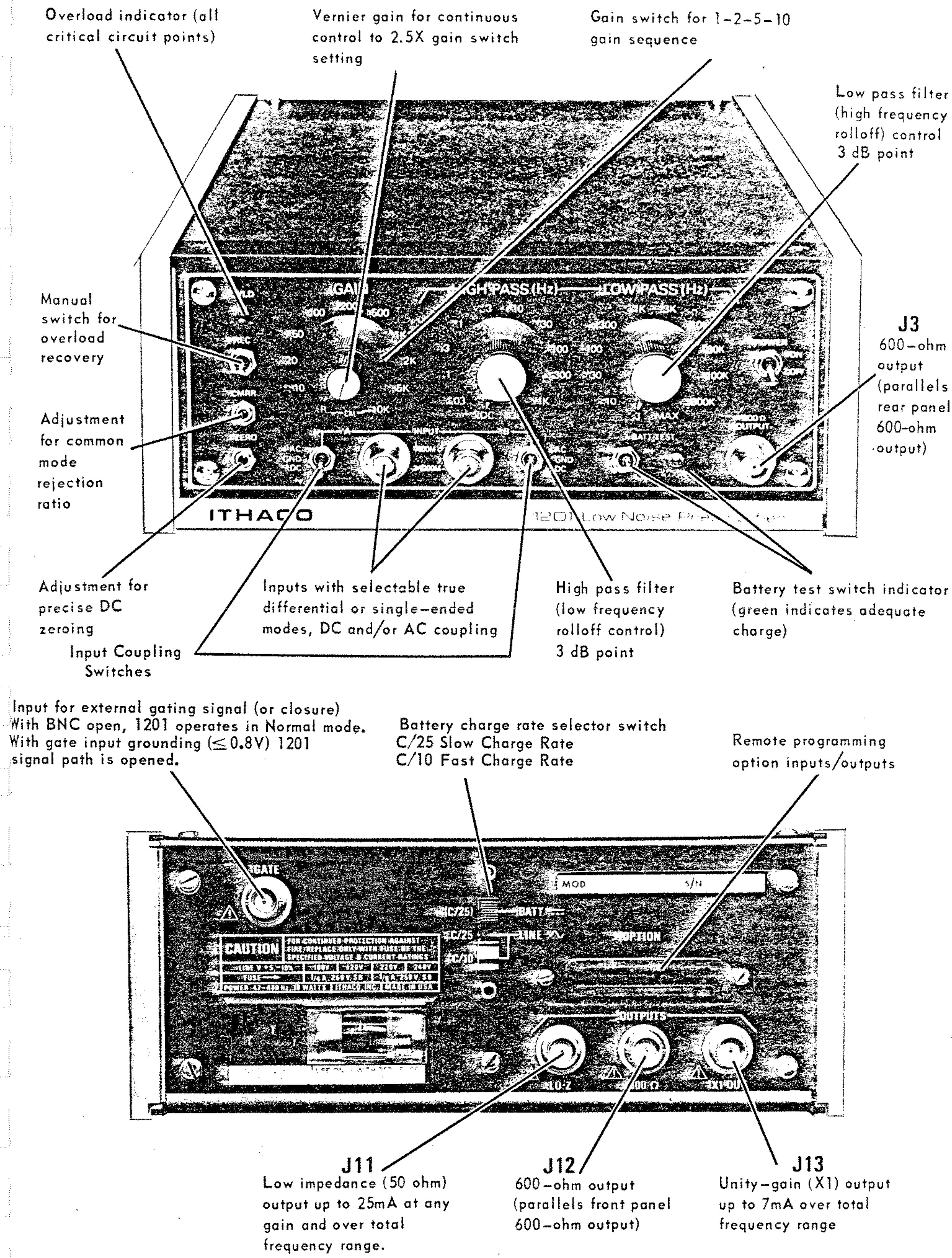


Figure 3.2

After verifying that your power source is correct, turn the unit "ON". Set the oscillator to 1 kHz, 0.1 volt rms. The 1201 should be providing a clean, 1 kHz, 1 volt rms signal at the 600 ohm and low-Z outputs and a 0.1 volt rms



Overload indicator (all critical circuit points)
Vernier gain for continuous control to 2.5X gain switch setting
Gain switch for 1-2-5-10 gain sequence
Low pass filter (high frequency rolloff) control 3 dB point
Manual switch for overload recovery
J3
600-ohm output (parallels rear panel 600-ohm output)
Adjustment for common mode rejection ratio
GAIN
HIGH PASS (Hz)
LOW PASS (Hz)
ITHACO
Adjustment for precise DC zeroing
Input Coupling Switches
Inputs with selectable true differential or single-ended modes, DC and/or AC coupling
High pass filter (low frequency rolloff control) 3 dB point
Battery test switch indicator (green indicates adequate charge)
Input for external gating signal (or closure) With BNC open, 1201 operates in Normal mode. With gate input grounding (≤0.8V) 1201 signal path is opened.
Battery charge rate selector switch
C/25 Slow Charge Rate
C/10 Fast Charge Rate
Remote programming option inputs/outputs
GATE
CAUTION
OPTION
OUTPUTS
J11
Low impedance (50 ohm) output up to 25mA at any gain and over total frequency range.
J12
600-ohm output (parallels front panel 600-ohm output)
J13
Unity-gain (X1) output up to 7mA over total frequency range

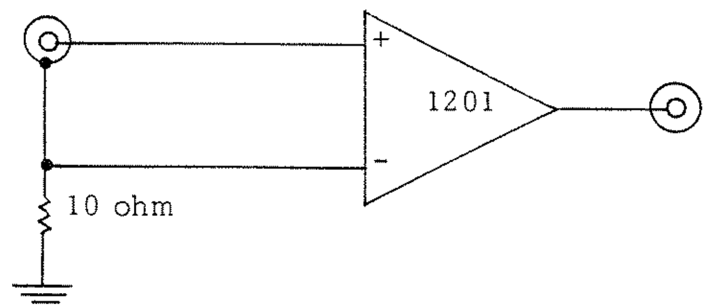
FIGURE 3.1

signal at the X1 output. At this point, it is recommended the user explore the functions of the various controls, as well as experiment with other frequencies and amplitudes. This will give a good feel for the operation of the 1201.

3.3 CONTROLS AND INDICATORS

3.3.1 INPUT SWITCHES

The following figures represent various combinations of input switch configurations and a simple diagram of how they effect the input section of the 1201. The two inputs operate in an essentially identical manner. The A input will provide output signals which are, for moderate frequencies, in phase with the input signals. The B Input is the inverting input, i.e., the 1201 output will be 180° out of phase with the input.



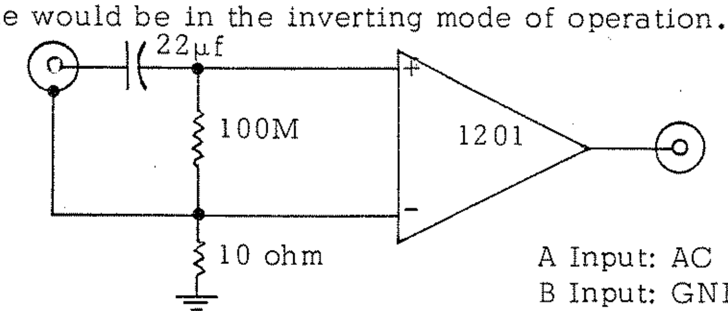
A Input: DC
B Input: GND

Figure 3.3

Figure 3.3 shows the 1201 in the single-ended, non-inverting, configuration.

The shields of the input BNC's are isolated by 10 ohms from the 1201 signal ground, which provides a high degree of ground loop immunity.

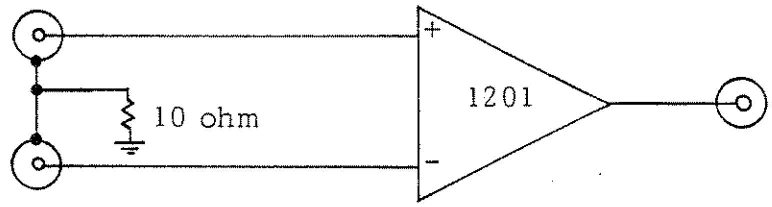
If the input switching arrangement were reversed, i.e., A Input: GND and B Input: DC, the operation of the 1201 would be identical except one would be in the inverting mode of operation.



A Input: AC
B Input: GND

Figure 3.4

The Figure 3.4 shows the 1201 in the AC coupled mode. This mode is useful in measuring AC signals in the presence of DC voltages up to 200V.



Both Inputs at DC (differential mode)

Figure 3.5

Figure 3.5 shows the 1201 in the differential input mode. In this mode, the output voltage is simply:

E_{out} = (A - B) X (1201 Gain)
where A = voltage applied to A Input
B = voltage applied to B Input

The differential mode is extremely useful and has many applications. One common application is illustrated in Figure 3.6.

The 1201 output will be zero, indicating null, when the bridge is balanced. This experiment takes maximum advantage of the differential input and common mode features of the 1201.

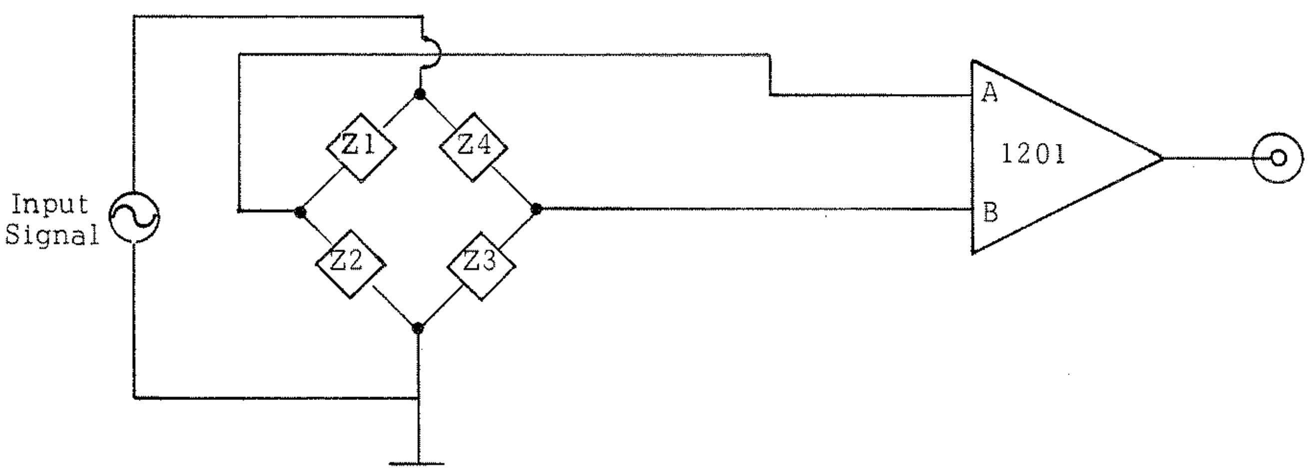


Figure 3.6

3.3.2 HIGH PASS FILTER

The high pass filter switch selects frequencies from DC to 3 kHz in a 1-3-10 sequence. The high pass filter attenuation is -6 dB/octave. The most counterclockwise position allows dc voltages to be amplified. At the frequency selected, the output will be 3 dB down (0.707), except, of course, in the DC positon.

3.3.3 LOW PASS FILTER

The low pass filter switch selects frequencies from 3 Hz to 300 kHz in a 1-3-10 sequence. Frequency response in the "MAX" position is at least to 400 kHz. The low pass filter attenuation is -6 dB/octave.

The high pass filter and low pass filter switches may be selected to reduce hum in the output, to reduce high frequency noise, as a bandpass to allow only one frequency through or in any other application where full bandwidth is not desired.

3.3.4 GAIN

Voltage gain from 10 to 25,000 may be selected using this switch and its associated variable control. Discrete steps in a 1-2-5-10 sequence from X10 to X10,000 are selectable and each step may be increased up to a factor of 2.5 using the variable gain control.

Gain accuracy is specified ±1% with the vernier in the CAL position.

Gain switching may also be accomplished with the -06 Remote Programming Option. The Remote Programming Option is selected by placing the gain switch in the "R" position. When not in the "R" position, the gain is determined by the gain setting selected, and overrides any input to the RPO.

When no Remote Programming Option is installed and the gain switch is in the "R" position, the gain stages go to low gain and the internal signal path becomes open so that little or no signal appears at any output (except the X1 output).

3.3.5 GATING

When the gate BNC on the rear panel is left open, the gating circuit is inactive and signals pass normally from input to output. When the gate input is grounded (0V up to approximately 0.8V), the gating circuit is activated and interrupts the signal path, preventing an active output.

The X1 output is excepted from this switching, as the amplifier is supplied from the factory. If it is desired to gate the X1 output, remove the jumper from terminals AA to BB on the Motherboard A3. Reconnect the jumper from terminal AA to terminal CC. In this position, the X1 output is also gated.

The gating feature is especially useful when strong overloading signals are present at the amplifier input at a predetermined time. For example, a strong transmitted pulse can be prevented from overloading the filters and the output amplifier when the 1201 is connected to receive an echo pulse through a transducer.

3.3.6 BATTERY SWITCH (BATT, C/25, C/10)

C/25 — The amplifier will probably be received from the factory with the switch in this position. With the line cord plugged in, the internal batteries trickle-charge. The 1201 electronics operate from the internal power supply.

C/10 — The batteries charge at the fast rate in this position. This instrument is provided with cooling holes but the user should not charge the batteries at C/10 (fast rate) for long periods at an unusually high ambient temperature or if the case has no air circulation. The build up of heat inside the case may shorten battery life. See Section 4.

In both C/25 and C/10 positions the batteries charge at the selected rate provided the line cord is connected to a power source. The amplifier receives power from the internal power supply.

BATT — In this switch position the batteries charge at the C/25 (slow) rate provided the line cord is connected to a power source. The amplifier receives power from the batteries, whether or not the line is plugged in.

To prevent excessive battery drain when operating in battery mode, do not operate for long periods of time with the overload light turned on with the inputs open in DC position or with the overload switch depressed (the contact is momentary). Also, try to avoid high load currents on the outputs, as this will reduce battery life.

3.3.7 BATTERY TEST

The Battery Test light illuminates when the BATT test switch is operated and the battery voltages are at 11.2 volts or more.

In the + position, the light indicates positive amplifier battery condition and in the - position the light indicates negative amplifier battery condition.

The battery test light does not indicate the amount of battery charge, but only whether there is a voltage over 11.2 volts. Therefore, the lamp will light even though the batteries are approaching the end of their useful charge life. To insure adequate battery charge after receipt from the factory, charge overnight before using at the C/10 rate. The batteries will charge at the selected rate even with the power switch off as long as the line cord is connected to a power source. See Section 4.

3.3.8 OVERLOAD LIGHT

The overload indicator lights when a voltage peak or a DC voltage exceeds the specified maximum value at any of three different points in the 1201. A detector after the first gain stage, one after the second gain stage and a detector for excessive common mode signal operates to turn on the light. A small hysteresis is built into the detector circuit so that the overload signal must be reduced below the level required to turn on the light, in order to turn the light off.

If an unexplained overload occurs, check the input signal first. Next check the input switch positions. If one channel is left unconnected with the input switch in DC position, the amplifier input currents may cause overload. Switch to ground (center position).

When operating in AC coupled mode, the instrument time constants are 22 seconds at the input and 5 seconds maximum at the high pass filter output. A momentary overload may require some time to clear itself. This may be speeded up by operating the overload recovery switch which decreases the time constants at both of these locations.

3.4 OUTPUTS

At the front panel output, J3, the output impedance is 600 ohms and it is tied to the same point as output J12 on the rear panel (two separate 600 ohm resistors). The Lo-Z output, J11 on the rear panel is also tied to the same point as J3 and J12. However, this connection is made through an internal 49.9 ohm resistor. Pads are provided on the printed circuit board for adding a resistor in series with the X1 output, J13, if desired. Simply cut the jumper between the pads and add the desired resistor in place of the jumper. Facing the unit from the front, the existing jumper is located on the extreme left hand rear corner of the main P.C.board, next to pin 61.

The X1 output on the rear panel is not connected to any other outputs. It is connected to the output of the first gain stage of the amplifier and therefore is not controlled by either the high pass or low pass switch, the gain switch, or the gating circuit. This output will be the same as the <u>differential</u> input, within the bandwidth limitations of the first stage.

3.5 1201-06 REMOTE PROGRAMMING OPTION

3.5.1 GENERAL DESCRIPTION OF CAPABILITIES

The 1201-06 Remote Programming Option is a general purpose interface for the 1201 which allows the user to control and read out many of the functions of the preamp. The capabilities of this option are listed below with a brief description of each function. More detailed information is available in the later sections (3.5.2 thru 3.5.3) and in the checkout procedure (section 1.3).

3.5.1.1 Control Functions

Through separate control lines, the user can remotely control Gain, overload recovery and gating.

When the front panel Gain Switch on the 1201 is set to "R", six control lines (two groups of three) allow remote control of the 1201 gain in discrete steps corresponding to those available on the front panel. The input lines are coded in binary (equivalent to BCD in this case) with 3 lines representing the Mantissa and 3 lines representing the Exponent. An error detector identifies invalid inputs and creates an "error" output in return. The 1201 will not try to execute invalid gain commands.

Overload recovery is effected through the use of one independent line. A low input on this line will activate the overload recovery function in the 1201. Operation of this line is in parallel with the front panel control.

The gating function in the 1201 is arranged so that it can be performed either at the rear panel GATE INPUT BNC or at the option input connector. One control line transfers gate control between the GATE INPUT BNC and the option. When the option is controlling the gate function, a second line determines whether the gate is on or off. When the gate is not controlled by the option, the GATE INPUT BNC functions normally. Refer to section 3.3.5 for normal operation of the 1201 gate.

3.5.1.2 Readout Functions

The 1201-06 is set up to read out most functions in the 1201. These include: gain status, high pass switch and low pass switch status, overload condition, remote gain control state, and gain input command error.

The readout functions are divided into two groups; multiplexed and nonmultiplexed. For efficient use of lines, all outputs except for gain error, overload and remote status, which have independent output lines, are multiplexed. The gain error output (discussed previously) indicates when the user is trying to execute an impossible gain command, while the remote status line indicates when the 1201 Gain Switch is in the "R" position (and the 1201 is under remote gain control).

When the analog signal levels go outside of the linear operating range, an Overload indication is provided on two lines. One line goes to a high state when a 1201 overload occurs, while the other line goes to a low state on overload. The negative logic output allows the use of wired "OR" connections in a multiple instrument system - more on this later.

All of the remaining output signals are multiplexed onto eight lines. On these lines, the following conditions can be read out: gain, gain uncalibrated, low pass setting, high pass setting, and 1201 identification. Coding on these lines is in positive-true Binary Coded Decimal (BCD) format. These are broken down as follows:

- 3 lines - Mantissa of Value
- 1 line - Value uncalibrated
- 3 lines - Exponent of Value
- 1 line - Sign of the Exponent

In order to select which function will be present at the outputs, two control lines are used as selectors.

<u>Gain</u> - when both selector lines are high (normal state), the output lines indicate the gain status of the 1201. At this time, the "uncalibrated" line indicates the status of the 1201 GAIN VERNIER POT. It should be noted that this gain output is the actual gain of the 1201, which may be different from the remote gain command on the gain control inputs.

High pass - when the first selector line is pulled low, the value on the output lines will represent the HIGH PASS SWITCH setting. This value translates directly to the 3dB cutoff frequency in Hertz except for the "DC" position which gives a value of Zero.

Low pass - when the second selector line is pulled low, the value on the output lines now represents the setting of the LOW PASS SWITCH. This again represents the 3dB cutoff frequency with the "MAX" position represented by a value of Zero.

1201 Identity - when both selector lines are pulled low, a value of 0 appears on the Mantissa and 1 appears on the exponent indicating a 1201 preamp.

3.5.1.3 Latching and Bussing

Several features are provided in the 1201-06 to aid in systems implementations. The most important of these is the "Device-Select Line" which allows parallel bussed and multiplexed operation of several 1201 amplifiers. When the device select line is pulled low, first, all control inputs are latched, and then all further changes on the input lines are ignored. This allows the system to talk to other 1201's which are connected to the bus. At the same time, all outputs except for the negative logic "Overload" output go to a high impedance state (15KΩ) allowing other 1201's to talk to the bus. Up to ten 1201's may be paralleled in this manner.

Another feature of the 1201-06 is the ability to perform parallel interrupt and serial polling of the overload condition. In a multiple amplifier system, the two overload output lines can be bussed between several amplifiers allowing one line to perform the interrupt function. When the system senses a low state on this line, it then can poll each amplifier on the other line to locate the overloaded instrument.

A third feature is the ability to latch the input data, in two groups, independently of the multiplexing. The two "Gain-change-enable" inputs allow the user to observe data on the output lines with the input data latched (otherwise not possible when multiplexing complete instruments). This also allows the user to bring data in in 8 bit words which simplifies use with a microprocessor.

In addition, the 1201 is capable of powering up in a Known state whenever the Gain-change-enable lines or the device-select line is active. The default values for the control functions are as follows:

GAIN	10
GATE CONTROL	Rear Panel BNC
Overload Recovery	inactive

Also, to give flexibility when interfacing to various Logic families, the user is able to choose both the input and output pullup voltages. Internal jumpers are provided which can easily be moved allowing a choice of an internal 5V pullup potential or an external, user supplied pullup potential. The external pullup voltage can be any voltage between 0 and +15VDC.

⚠ WARNING: Because of possible shock and fire hazards, these jumpers should only be moved by a qualified technician.

3.5.1.4 Input/Output Line Requirements

Depending on which functions are used, the number of Input/Output lines required will vary. Below is a list of some normal arrangements and the number of lines required. Note that the "remote" line is not essential, since the input and output can be compared to determine this condition.

☐ Blank = no

Y = yes

( ) = required

Configuration	Gain Control	Gate Control	Recovery Control	Gain Readout	HP/LP Readout	Multiplexed	8 Bit Words	Remote Output	Overload Output	Serial Poll of Overload	Gain Error Output	Total # of Lines Required
Normal Minimum	Y	Y	Y	Y	Y				Y			18
Readout Only				Y	Y			Y	Y			10
Gain Control Only	Y											6
Full Control Only	Y	Y	Y									9
Normal Multiplexed Minimum	Y	Y	Y	Y	Y	Y			Y			19
"Adders" "Remote" Output								Y				+1
Serial Poll of OVLD						(Y)			(Y)	Y		+1
Gain Error Output	(Y)										Y	+1
8 Bit Input Words	(Y)	(Y)	(Y)				Y					+2
MAXIMUM	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	24

3.5.2 DESCRIPTION OF CONTROL LINES & FUNCTIONS

This section is broken up into sections which discuss the various input and output lines and describe requirements to make the option function. Refer to Table 3.1 for a brief listing of signal lines and their functions.

3.5.2.1 Control and Latching Lines

These are the nine input lines which are directly responsible for control of 1201 functions and the two lines which enable the input latches.

<u>Gain Inputs and Gain change enable input</u>
(PINS 20 to 26 and 35)
The gain input lines which are coded in a Mantissa/exponent format supply the value which is stored in the gain input latch. Since there are only three lines for either the Mantissa or the exponent, the inputs can be considered to be coded in either Binary or BCD.

This is shown graphically in table 3.2. Note that PIN 26 (EXPS) is completely ignored by the 1201-06 option.

In order for this value of gain to enter in the gain input latch, the following conditions must be true:

PIN 35 (GCE1) = 1 (TRUE)
PIN 34 (DSEL) = 1
The gain represented by the inputs must be a valid 1201 gain.

If these conditions are not met, the new value will be blocked from entering the gain input latch, and the old value will remain there.

TABLE 3.1

1201-06 INPUT/OUTPUT LINES

J1 PIN #	MNEMONIC	FUNCTION	VALUE WHEN HIGH
1	V_{OUT}	User supplied output pullup Voltage	15VDC MAX
2	MA+$\overline{DSEL}$	Mantissa Output, least significant bit	1
3	MB+$\overline{DSEL}$	Mantissa Output, 3rd significant bit	2
4	MC+$\overline{DSEL}$	Mantissa Output, 2nd significant bit	4
5	MD+$\overline{DSEL}$	Mantissa Output, most significant bit	8
6	MLT+$\overline{DSEL}$	Mantissa Output, uncalibrated	not used uncal.
7	MS+$\overline{DSEL}$	Mantissa Output, sign	(+)
8	ERROR+$\overline{DSEL}$	Gain error output	command error
9	DIG GND	Digital ground	---
10	REM+$\overline{DSEL}$	Remote status output	remote gain
11	EA+$\overline{DSEL}$	Exponent Output, least significant bit	x 10
12	EB+$\overline{DSEL}$	Exponent Output, 3rd significant bit	x 100
13	EC+$\overline{DSEL}$	Exponent Output, 2nd significant bit	x 10,000
14	ED+$\overline{DSEL}$	Exponent Output, most significant bit	not used
15	EE+$\overline{DSEL}$	Exponent Output	not used
16	ES+$\overline{DSEL}$	Exponent Output, sign	(+)
17	OVLD+$\overline{DSEL}$	1201 Overload Output, multiplexed	overload
18	$\overline{OVLD}$	1201 Overload Output, unmultiplexed	no overload
19	VIN	User supplied input pullup Voltage	15VDC MAX
20	GA	Gain Mantissa input, least sig. bit	1
21	GB	Gain Mantissa input, 2nd sig. bit	2
22	GC	Gain Mantissa input, most sig. bit	4
23	EXPA	Gain Exponent input, least sig. bit	x 10
24	EXPB	Gain exponent input, 2nd sig. bit	x 100
25	EXPC	Gain exponent input, most sig. bit	x 10,000
26	EXPS	Gain exponent sign	not used
27	SEL 1	Selector inputs (control use of output lines)	see Table 3.Y
28	SEL 2		
29	SEL 4		

TABLE 3.1 (Con't) 1201-06 INPUT/OUTPUT LINES

J1 PIN #	MNEMONIC	FUNCTION	VALUE WHEN HIGH
30	$\overline{\text{RECY}}$	Overload recovery input	inactive
31	$\overline{\text{GOR}}$	Gate override input	gate control at GATE BNC
32	GATE	Remote gate control input	1201-normal Function
33	----		not used
34	DSEL	Device Select input	all other inputs enabled
35	GCE1	Gain change enable input	control latches follow remote inputs
36	GCE2	Gate/Recovery change enable input	control latches follow remote inputs

TABLE 3.2

VALID GAIN INPUTS

Inputs

Gain	22 GC	21 GB	20 GA	25 EXPC	24 EXPB	23 EXPA	26 EXPS
	Pin Number/Name						
10	0	0	1	0	0	1	X
20	0	1	0	0	0	1	X
50	1	0	1	0	0	1	X
100	0	0	1	0	1	0	X
200	0	1	0	0	1	0	X
500	1	0	1	0	1	0	X
1K	0	0	1	0	1	1	X
2K	0	1	0	0	1	1	X
5K	1	0	1	0	1	1	X
10K	0	0	1	1	0	0	X

1 = HIGH
0 = LOW
X = DON'T CARE

In the event that either PIN 35 (GCE1) or PIN 36 (DSEL) is low, the gain inputs will have no effect on the latch. Also, if the previously mentioned conditions are not present when 1201 power is turned on, the latch will power-up with a value of 10. Note that if no connection is made to the option, the internal pullups on the gain inputs will cause an invalid gain input, resulting in a value of 10 to be stored in the latch.

The latching of gain inputs just discussed is totally independent of the front panel GAIN switch. This means that the front panel GAIN switch can be in any position while data is being transferred into the latch. The actual gain of the 1201, however, is controlled by the front panel, and is equal to the value in the latch only when the GAIN switch is in the "R" position.

GATE/Recovery Control and Enable Lines
(PINS 30, 31, 32, 36)
The gate and (overload) recovery inputs are latched in a similar manner to the gain inputs. In order to change the value stored in these latches, the following conditions must be true:

PIN 36 (GCE2) = 1
PIN 34 (DSEC) = 1

For gate operation, PIN 31 ($\overline{GOR}$) determines whether the rear panel GATE INPUT BNC or the remote gate input PIN 32 (GATE) controls the 1201 gating function. When PIN 31 ($\overline{GOR}$) is high, gating is done by the rear panel BNC; when low, gating is done by PIN 32 (GATE) input. In either case, a low input on the active gate input will turn the 1201 gain channel "off". The truth table for this operation is shown in Table 3.3. Note that when no connection is made to the option, the internal pullups cause the gate control to default to the rear panel BNC.

Overload recovery is simpler in that either the front panel switch or the remote input PIN 30 ($\overline{RECY}$) will effect overload recovery regardless of the state of each other. See Table 3.4.

If either PIN 36 (GCE2) or PIN 34 (DSEC) is low when 1201 power is turned on, the latchs will power up to a value of 1. i.e., gate control will be at the rear panel and the overload recovery function will be inactive.

3.5.2.2 Special Output Lines (PINS 8, 10, 17, 18) Refer to Table 3.5.

Gain error output PIN 8 (ERROR + $\overline{DSEL}$)
When PIN 34 (DSEL) is high, the gain error output (PIN 8) indicates the presence of an invalid gain combination at PINS 20 thru 26. A high level at PIN 8 (ERROR + $\overline{DSEL}$) indicates an input gain error. The functioning of this pin is not affected by either the front panel GAIN switch or the gain-change-enable input (PIN 35).

Remote Status output PIN 10 (REM + $\overline{DSEL}$)
When PIN 34 (DSEL) is high, the remote status output (PIN 10) indicates the position of the front panel GAIN switch. When the front panel GAIN is set to "R", a high level will appear at this output, indicating that the 1201 gain is being controlled by the input gain latch.

Overload Outputs PIN 17 (OVLD + $\overline{DSEL}$),
PIN 18 ($\overline{OULD}$)
These outputs indicate whether or not the 1201 is overloaded, which corresponds directly to the indication on the 1201 front panel OVLD light. When PIN 34 (DSEL) is high, PIN 17 (OVLD + DSEL) will indicate an overload condition by a high output, while PIN 18 (OULD) will indicate an overload by a low output regardless of the state of PIN 34 (DSEL).

TABLE 3.3

GATING OPERATION

GOR PIN 31	GATE PIN 32	GATE BNC	1201 GAIN CHANNEL
1	X	1	ON
1	X	0	OFF
0	1	X	ON
0	0	X	OFF

1 = HIGH

0 = LOW

X = DON'T CARE

TABLE 3.4

OVERLOAD RECOVERY

FRONT PANEL SWITCH	$\overline{\text{RECY}}$ PIN 30	1201 OVERLOAD RECOVERY FUNCTION
ON	X	ON
X	0	ON
OFF	1	OFF

If parallel interrupt and serial polling operation is desired, simply hook all PIN 17's together, and all PIN 18's together. When an interrupt occurs (PINS 18 go low), use the device select line (PIN 34) to poll each unit, watching PINs 17 (0VLD + $\overline{\text{DSEL}}$) for an overload indication.

TABLE 3.5

SPECIAL OUTPUTS

Output Pin	DSEL Input	Output Level	High Level Indicates
ERROR + $\overline{\text{DSEL}}$ PIN 8	0 1	1(hi Z) ————>	---- Input Gain Error
REM + $\overline{\text{DSEL}}$ PIN 10	0 1	1(hi Z) ————>	---- Remote Gain Control
0VLD + $\overline{\text{DSEL}}$ PIN 17	0 1	1(hi Z) ————>	---- 1201 Overloaded
$\overline{\text{0VLD}}$ PIN 18	X	————>	1201 Not Overloaded

3.5.2.3 Selector inputs and shared output lines PINS 27, 28, 29 & PINS 2, 3, 4, 5, 6, 7, 11, 12, 13, 14, 15, 16

When PIN 34 (DSEL) is high, the selector inputs (PINS 27-29) determine which value is to be outputted on the shared output lines (PINS 2......16). Refer to Table 3.6 for the input codes. Note that PIN 29 (SEL4) is active, although it is not needed for 1201 operation.

TABLE 3.6

SELECTOR CODES

Select Code	PIN 29 SEL 4	PIN 28 SEL 2	PIN 27 SEL 1	Output
0	0	0	0	Not Used (+0 x 10°, CAL)
1	0	0	1	Not Used (+0 x 10°, CAL)
2	0	1	0	Not Used (+0 x 10°, CAL)
3	0	1	1	Not Used (+0 x 10°, CAL)
4	1	0	0	1201 Identity (+0 x 10^1, CAL)
5	1	0	1	Low Pass Switch Setting
6	1	1	0	High Pass Switch Setting
7	1	1	1	1201 Gain

Coding on the shared output lines is in BCD format, with these lines broken up into two groups; Mantissa and Exponent. The value at the output can be represented as an integer number as follows.

$$\text{VALUE} = (\text{MANT}) \times 10^{(\text{EXP})(\text{SIGN})}$$

where SIGN +1 for PIN 16 (ES + $\overline{\text{DSEL}}$) HIGH
-1 for PIN 16 LOW

MANT = (4 x PIN 4 + 2 x PIN 3 + PIN 2)

EXP = (4 x PIN 13 + 2 x PIN 12 + PIN 11)

Note that the effective location of the decimal point is to the right of the first (only) digit of the Mantissa. Also, when PIN 6 (MLT + $\overline{\text{DSEL}}$) is high, the value indicated above is uncalibrated.

PINS 5, 7, 14, and 15 are not used.

Tables 3.7, 3.8, and 3.9 below list all of the valid output combinations for Gain, High Pass, and Low Pass.

TABLE 3.7 GAIN OUTPUTS (Select Code 7)

1201 GAIN	PIN 4 MC+$\overline{DSEL}$	PIN 3 MB+$\overline{DSEL}$	PIN 2 MA+$\overline{DSEL}$	PIN 13 EC+$\overline{DSEL}$	PIN 12 EB+$\overline{DSEL}$	PIN 11 EA+$\overline{DSEL}$	PIN 16 DS+$\overline{DSEL}$	Abbreviated
10	0	0	1	0	0	1	1	1E1
20	0	1	0	0	0	1	1	2E1
50	1	0	1	0	0	1	1	5E1
100	0	0	1	0	1	0	1	1E2
200	0	1	0	0	1	0	1	2E2
500	1	0	1	0	1	0	1	5E2
1000	0	0	1	0	1	1	1	1E3
2000	0	1	0	0	1	1	1	2E3
5000	1	0	1	0	1	1	1	5E3
10000	0	0	1	1	0	0	1	1E4

TABLE 3.8 HIGHPASS OUTPUTS (Select Code 6)

1201 HIGHPASS SETTING	PIN 4 MC+$\overline{DSEL}$	PIN 3 MB+$\overline{DSEL}$	PIN 2 MA+$\overline{DSEL}$	PIN 13 EC+$\overline{DSEL}$	PIN 12 EB+$\overline{DSEL}$	PIN 11 EA+$\overline{DSEL}$	PIN 16 ES+$\overline{DSEL}$	Abbreviated
DC	0	0	0	0	0	0	1	OEO
.03 HZ	0	1	1	0	1	0	0	3E-2
.1	0	0	1	0	0	1	0	1E-1
.3	0	1	1	0	0	1	0	3E-1
1	0	0	1	0	0	0	1	1EO
3	0	1	1	0	0	0	1	3E0
10	0	0	1	0	0	1	1	1E1
30	0	1	1	0	0	1	1	3E1
100	0	0	1	0	1	0	1	1E2
300	0	1	1	0	1	0	1	3E2
1000	0	0	1	0	1	1	1	1E3
3000 HZ	0	1	1	0	1	1	1	3E3

TABLE 3.9 LOWPASS OUTPUTS (Select Code 5)

1201 LOWPASS SETTING	PIN 4 MC+$\overline{\text{DSEL}}$	PIN 3 MB+$\overline{\text{DSEL}}$	PIN 2 MA+$\overline{\text{DSEL}}$	PIN 13 EC+$\overline{\text{DSEL}}$	PIN 12 EB+$\overline{\text{DSEL}}$	PIN 11 EA+$\overline{\text{DSEL}}$	PIN 16 DS+$\overline{\text{DSEL}}$	Abbreviated
3 HZ	0	1	1	0	0	0	1	3EO
10	0	0	1	0	0	1	1	1E1
30	0	1	1	0	0	1	1	3E1
100	0	0	1	0	1	0	1	1E2
300	0	1	1	0	1	0	1	3E2
1000	0	0	1	0	1	1	1	1E3
3K	0	1	1	0	1	1	1	3E3
10K	0	0	1	1	0	0	1	1E4
30K	0	1	1	1	0	0	1	3E4
100K	0	0	1	1	0	1	1	1E5
300K	0	1	1	1	0	1	1	3E5
MAX	0	0	0	0	0	0	1	0E0

3.5.2.4 Device select line PIN 34

The device select line (DSEL) allows the user to multiplex several 1201's together. This is done by paralleling all other connections on the OPTION CONNECTOR, between units, and driving one DSEL line high at a time.

When the DSEL line (PIN 34), goes low, several things happen. First, the input latches are gated off, not allowing any further changes in their state. This holds the gain, overload recovery and gating commands regardless of further changes on the input pins or the gain change enable inputs (PINS 35 & 36). Note however, that the pullup resistors on the inputs are still connected. At the same time, the output selector lines are disabled.

The second effect of $\overline{\text{DSEL}}$ going low is that all outputs except $\overline{\text{OVLD}}$ (PIN 18) will go to a high impedance state. This state is characterized by a 15KΩ resistor connected to the output pullup voltage.

3.5.2.5 External pullup voltages PINS 1, 19

Two pins are provided to allow the user to select the high state voltage for the inputs and the outputs. By the use of two internal jumpers, the user can select either the 5 Volt internal pullup or the user supplied pullup voltage (at PINS 1, 19).

PIN 19 (VIN), when selected by the internal jumper, supplies the pullup voltage for all input pins, this voltage being applied to each pin through a 68KΩ resistor. The allowable range of Voltage is 0 to 15 VDC, although 5 to 15 Volts is recommended. When a voltage below approximately 2.4 VDC is used, the Schmitt triggers on the inputs will not see a logic 1 unless driven high by the external circuitry.

PIN 1 (VOUT), when selected by the internal jumper, supplies the pullup voltage for all outputs: the pullup resistor in this case is 15KΩ. The pullup voltage, again, may be any voltage between 0 and 15 VDC.

Aside from providing compatibility with various logic families, using these pins can improve the noise immunity of a system by using higher voltages for input/output data.

⚠ WARNING: Because of possible shock and fire hazards, the Input & Output jumpers should only be moved by a qualified technician.

3.5.2.6 Ground - PIN 9

One pin is supplied on the rear panel connector to supply a ground reference. In normal configurations, this pin should be used for all ground connections to external digital equipment.

3.5.2.7 Signal Timing

3. .2.7.1 Input Latches

Data Setup Time - TDS - In order for the inputs (PINS 20, 21, 22, 23, 24, 25, 30, 31, 32) to settle properly, the data on these lines must be present for at least 4.0 μSec before any of the following occur:

PIN 34 (DSEL) high to low transition
PIN 35,36 (GCE1 or GCE2) high to low transition (for appropriate data lines)
change to an invalid input gain code (for gain control lines only)

3.5.2.7.2 Gain change rate

Due to the use of relays to control gain in the 1201, the execution of a gain change is delayed by a relatively long time. This time is typically 50 mSec and is guaranteed to be less than 100 mSec. Settling time of the 1201 must be added to this number, and will depend on high pass & low pass settings. Note that the input latching rate is much faster than the gain change rate.

3.5.2.7.3 Output Select Settling (delay) Time

Data on the shared output lines (PINS 2, 3, 4, 6, 11, 12, 13 & 16) will not be valid until 50μSec after the last occurance of any of the following events:

-any change of PINS 27, 28, 29 (selector inputs)
-low to high transition of PIN 34 (DSEL)
-any change of selected reading (High pass switch, low pass switch, gain switch)

3.5.3 OPERATING CONSIDERATIONS

3.5.3.1 Static Protection

The 1201 remote programming option incorporates static discharge protection which will protect it from normal use. However, if the instrument is to be used in a carpeted area or in industrial environments, the user should take extra precautions to prevent damage. Damage from static discharge of personnel can be eliminated by first touching the 1201 case before touching the connector. When operating near processes where high voltages (>1000V) are discharged suddenly, care must be taken to avoid high voltages from being coupled via stray capacitance or via common grounds.

3.5.3.2 Logic Levels & Noise Immunity

The 1201-06 is set up to work in moderately noise-free environments. For example, with the internal 5 Volt pullups and typical input thresholds, a logic 0 input of 0 Volts will have a noise margin of 2.4 Volts, and a logic 1 level of 5 Volts will have a noise margin of 3.4 Volts.

If these levels are inadequate, one quick cure is to increase the pullup voltage. This will increase the high level noise margin to approximately 13 Volts, but will do little for the low level noise margin. If speed of operation is no problem, a R-C network can be used at the inputs to reduce noise. See Figure 3.7. Otherwise, opto isolators can be used.

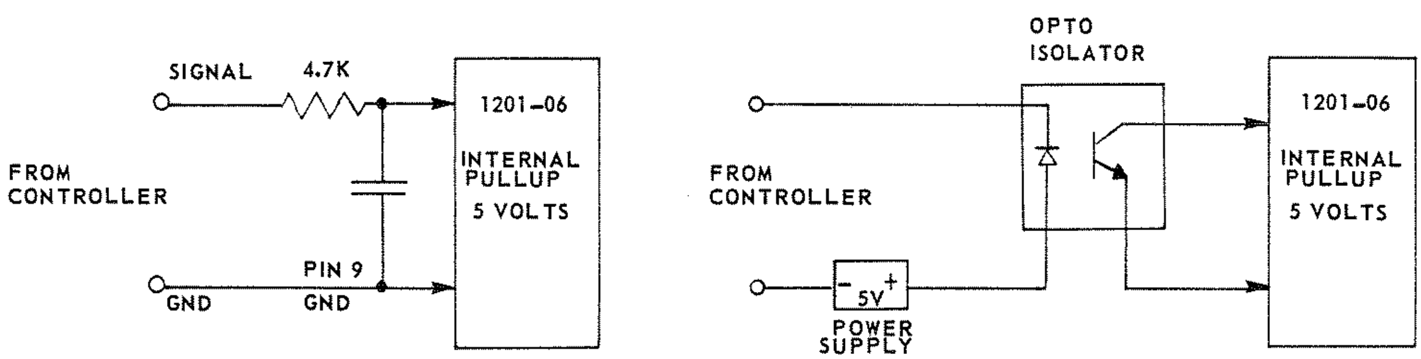


FIGURE 3.7 INPUT CIRCUITS FOR INCREASED NOISE IMMUNITY

For outputs, external pullup voltages (up to 15 Volts), differential line receivers, or opto isolators may be used to reduce sensitivity to noise. See Figure 3.8.

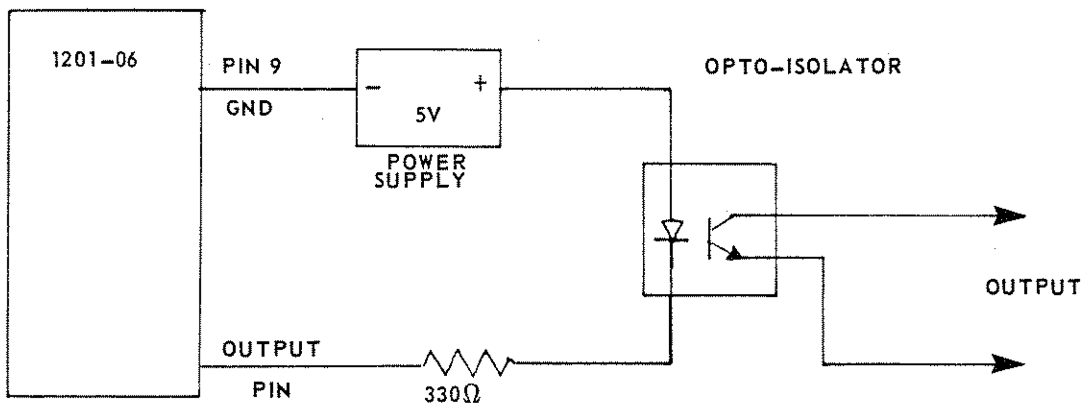


FIGURE 3.8 ISOLATED OUTPUT